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U.S. Securities and Exchange Commission

ACQUISITION OF TECHNOLOGY-BASED FIRMS
BY TENDER OFFER: AN ECONOMIC AND FINANCIAL ANALYSIS

OCTOBER 1980

Capital Market Working Papers

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Capital Market
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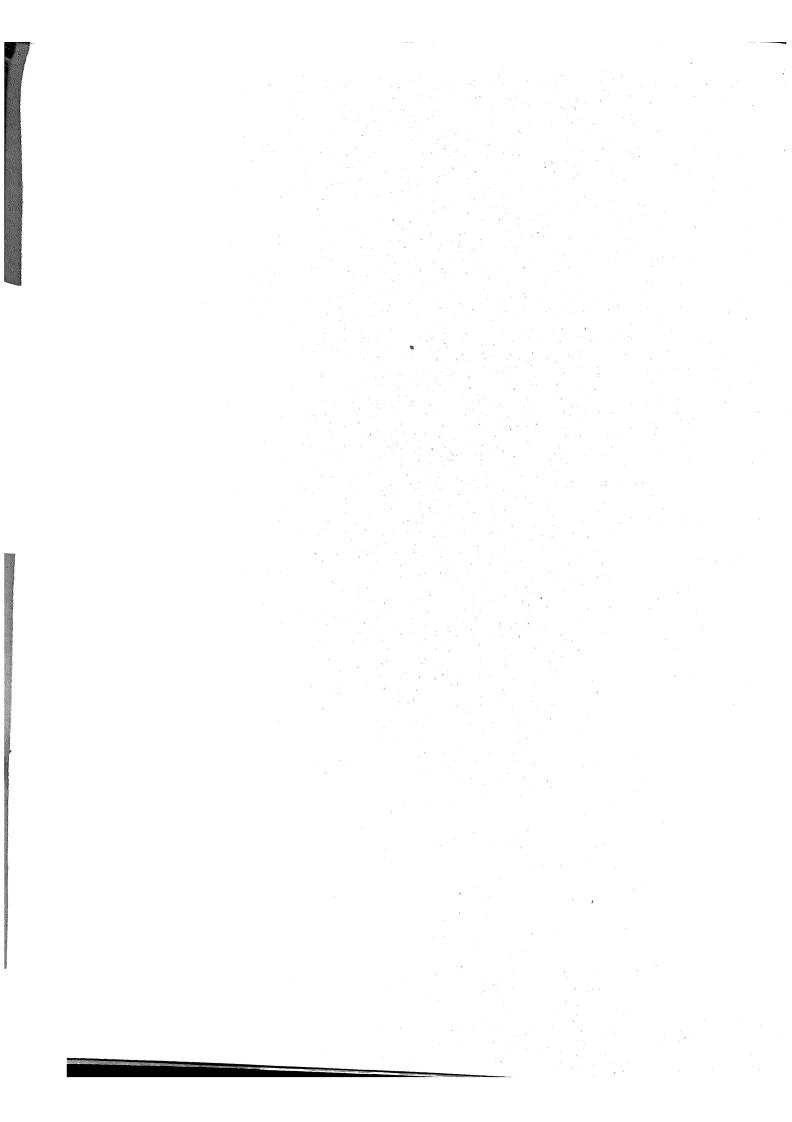
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October 1980

U. S. Securities and Exchange Commission

Directorate of Economic and Policy Analysis

Washington, D. C. 20549

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1. INTRODUCTION

Many smaller technology-based firms disappear each year through mergers and acquisitions by larger firms. Since investors in new enterprises are well aware of this possibility, the question arises as to whether this situation affects the ability of small firms to raise capital. If stockholders in small firms benefit from being acquired, then possible future acquisitions should enhance the small firm's ability to raise capital; if stockholders are hurt, possible future acquisitions can be detrimental to the small firm. This issue is explored by focusing on one of the major vehicles for effecting such acquisitions, namely, tender offers.

The objective of this study is to measure the effects of acquisition by tender offer on the stockholders of small firms. To do so, price changes in the common stock of smaller technology-based firms are studied around the tender offer announcement and expiration dates. Further, tender offer premiums and the degree of competition in the tender offer process are analyzed to assess whether tender offer terms in acquisitions of large firms differ systematically from the terms in acquisitions of small firms.

2.   OVERVIEW OF THE TENDER OFFER MECHANISM

Defined by its basic characteristics, a tender offer is an offer
to purchase stock of a firm (1) at a fixed offer price, (2) for a
fixed period of time, and (3) with possible limitations on the minimum
and maximum number of shares to be purchased. Generally, the
offer price exceeds the stock's market price prior to the offer
announcement, and this differential is often termed the offer
premium.

Corporate takeover and/or acquisition by means of tender
offers has increased sharply over the last fifteen years. Regulation
of this activity came with the passage of the Williams Act in
1968. The Williams Act and the rules and regulations promulgated
thereunder by the Securities and Exchange Commission ("SEC") set
forth disclosure requirements, impose a minimum offer period,
and establish anti-fraud provisions applicable to tender offers.
Accordingly, the bidder in a public tender offer must file a Schedule
14 D disclosure form with the SEC prior to commencing the offer.
Tender offers must be outstanding for ten days (recently revised
to twenty business days 1/) and, in oversubscribed offers, purchase
of stock tendered must be on a pro rata basis. Finally, the general
anti-fraud provisions prohibit material misstatements, omissions
or other deceptive actions in connection with any tender offer.

1/   Securities Act Release No. 6158 (November 29, 1979).

3.   HYPOTHESES

In an efficient capital market, security prices reflect all publicly available information concerning securities' expected future cash flows. Thus, in an efficient capital market, the public announcement of a forthcoming tender offer should induce price adjustments in the firm's securities which capitalize the tender offer effects on a stockholder's expected cash flows. Given a stockholder's ability to tender his stock at an offer premium, Bradley (1980) shows that a stock's price, once a tender offer is announced, P_A , must equal a weighted average of the offer price, P_T , and the expected post-offer stock price, $\overline{P}_E$; that is,

$$(1) \qquad P_A = \overline{\alpha}\, P_T + (1 - \overline{\alpha})\, \overline{P}_E \ ,$$

where $\overline{\alpha}$ = the expected fraction of shares tendered and purchased. 2/

This relationship simply reflects the stockholder's expected future cash flows, where $\overline{\alpha}$ can be interpreted as the probability of a stockholder receiving the tender offer price, while $\overline{P}_E$ is the present value of the expected future cash flow to post-offer stockholders.

By subtracting and dividing both sides of the above equation by the pre-announcement stock price, P_O, this relationship can be transformed into

$$(2) \qquad R_A = \overline{\alpha}\, PREM + (1 - \overline{\alpha})\overline{R}_O \ ,$$

2/ This definition of $\overline{\alpha}$ assumes that once an offer is announced, it is not cancelled.

where

$$R_A = (P_A - P_O)/P_O = \text{stock's announcement period return;}$$

$$PREM = (P_T - P_O)/P_O = \text{offer premium; and}$$

$$\overline{R}_O = (\overline{P}_E - P_O)/P_O = \text{stock's expected offer period return.}$$

Equation (2) states that a stock's announcement period return is equal to a weighted average of the offer premium and expected offer period return (which reflects the expected "permanent" change in stock price due to the offer). As a consequence of this relationship, a stock's announcement period return can be interpreted as capturing effects of both the transitory offer premium and the expected permanent change in stock price due to the offer.

Given that stockholders in the target firm can have heterogeneous expectations of their stock's current value and heterogeneous unrealized capital gains liabilities, a number of stockholders may not find it in their best interests to tender at a given offer premium. Consequently, the existence of a tender offer premium does not insure that all stockholders are made better off in a tender offer. Post-offer minority stockholders will be better off only if the post-offer stock price exceeds the pre-announcement stock price or, equivalently, if the offer period return is positive. Consequently, in evaluating the effects of tender offers on target stockholders, the magnitude of the offer premium and the sign and the magnitude of the offer period return must be considered. Furthermore, the announcement period return can be viewed as a means of jointly evaluating the two effects of the tender offer.

Recently, a number of hypotheses have been suggested which imply
that tender offers benefit tendering stockholders and, for some of these
hypotheses, benefit the non-tendering stockholders as well. Manne (1965),
and more recently Dodd-Ruback (1977), hypothesize that tender offers may
be motivated by (1) an expectation of increasing the target firm's
internal efficiency through a take-over of control, and (2) an expectation
of realizing synergistic benefits or monopoly power through a merger with
the bidder. Grossman-Hart (1980a, 1980b) posits a third hypothesis which
assumes that bidders invest in the production of new information to
determine which potential target firm stocks are underpriced. However,
a bidder can only capture the value of this non-public information through
a tender offer for the target shares at an offer price below the shares'
market value if the new information was to become public. Then unless
a bidder is able to dilute the value of the holdings of minority stockholders
remaining after expiration of the offer, all stockholders individually
will choose not to tender, since they can deduce that the stock must
be worth more than the tender offer price.

All three hypotheses predict positive offer premiums and stock
price increases for target firms on the announcement of a tender offer.
Further, the third hypothesis predicts that after offer expiration the
target firm's stock price will fall relative to its pre-announcement
price to reflect expected minority stockholder dilution, while the first
two hypotheses predict a post-expiration price exceeding its pre-announcement
price.

The common implication of the first two hypotheses for the target firm's
stockholders is that a tender offer will be to their benefit because:

(1)   the tender offer price exceeds the pre-offer stock price; and

(2)   the post-offer stock price is also above the pre-announcement

stock price. Consequently, whether a stockholder tenders or not,

he must gain from the offer. However, under the third hypothesis,

the post-offer price will be below the pre-announcement stock price,

so that the stockholder's welfare is uncertain because even if he

does tender all his shares, all shares tendered may not be purchased,

and the stockholder will lose on the shares held after the offer

expires. Further, if the stockholder chooses not to tender, his

welfare is adversely affected. Consequently, if this third hypothesis

has empirical validity, capital formation capabilities of smaller

technology-based firms can be inhibited by the possibility of a

future tender offer.

4.   REVIEW OF EXISTING EMPIRICAL EVIDENCE

At present, three carefully executed studies of tender offer

effects exist in the academic literature: Bradley (1980), Dodd-Ruback

(1977), and Jarrell-Bradley (1980). Each of these studies analyzes

New York Stock Exchange ("NYSE") and American Stock Exchange ("ASE")

listed target firms. 3/ All three studies analyze stock price adjust-

ments or stock returns around the tender offer announcement for both

target and bidding firms. In addition, Bradley analyzes the stock

price changes at offer expiration and assesses the empirical significance

of the relationship defined by equation (1):

(1') $P_A = \alpha P_T + (1 - \alpha)P_E$,

where actual values have been substituted for the expected values, $\bar{\alpha}$ and

$\bar{P}_E$.

3/   While Dodd-Ruback studies monthly stock returns, Bradley and Jarrell-
     Bradley study daily stock price changes.

All three studies find positive tender offer premiums and large

positive announcement date price adjustments for target firms and small

positive announcement date price adjustments for bidding firms. These

studies also stratify their samples into successful and unsuccessful

offers (with success defined in terms of the number of shares tendered

relative to the number sought) and find relatively little difference in

the two subsamples' offer premiums or announcement period price changes. 4/

Focusing on successful offers, Bradley observes a small price decline

of .04% for target stocks at offer expiration. However, on average, the

target stock's post-offer price exceeds its pre-announcement price.

In the case of unsuccessful offers, the post-expiration price of the

target firm's stock is usually above both its pre-announcement price and

its offer price. Bradley also estimates a linear regression based on

the relationship expressed in equation (1') to test its empirical validity

and finds the coefficients to be statistically significant and capable

of explaining 88% of the cross-sectional variation in the announcement

price changes of 161 target firms. 5/ Austin (1980) studied the basic

characteristics of all tender offers made in the 1978-1979 period,

including comparisons with earlier periods. One important piece of

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4/   For example, Dodd-Ruback reports that the announcement period stock
       returns in successful offers for 124 targets and 48 bidders averaged
       20.9% and 2.8%, respectively; for unsuccessful offers, the
       stock returns for 36 targets and 48 bidders averaged 1% and .6%,
       respectively.

5/   Jarrell-Bradley also reports a statistically significant rise in
       offer premium, offer duration, and announcement period returns of
       target stocks over the last 15 years, which is claimed to be the
       result of increasingly stringent government regulation of tender
       offers.

evidence Austin presents is the distribution of offer premiums over the period 1976 through mid-1979; the median value found by Austin was 20%. [6]

While these studies indicate that tender offers are beneficial to stockholders of NYSE and ASE listed target stocks, it is not clear that these results also hold for over-the-counter ("OTC") traded stocks of technology-based firms, which are generally smaller than firms listed on the NYSE or the ASE. This study will attempt to answer that important question. Another important question, though not addressed here, is the effect of acquisitions on the bidding firm's stockholders.

5. DATA DESCRIPTION

The basic data sources for the tender offers studied in this paper were the SEC Statistical Bulletin and the SEC News Digest, which list all Schedule 14D filings (Schedule 13D filings before August 1977) with the SEC. Since the passage of the Williams Act in 1968, bidding firms in most tender offers must file a disclosure statement (i.e., Schedule 14D) with the SEC prior to offer commencement. [7]

During the sample period (mid-1973 through the end of 1979), there were 844 separate Schedule 14D filings with the SEC, of which approximately 618 were for OTC traded target firms. Of particular interest to this study is that group of offers which were made for technology-

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[6] The offer premium is calculated using as the pre-announcement price the closing price two weeks prior to the announcement of an offer.

[7] See Aranow-Einhorn-Berlstein (1977) for additional details.

based target firms. The fifteen industries classfied as technology-based industries are listed in Table 1. 8/

In all, 45 offers for technology-based target firms were found. However, reliable daily quotes for these firms' common stocks were available for only the 27 firms listed on the National Association of Security Dealers Automated Quotations System ("NASDAQ"). The source for these quotes is the Standard & Poor's OTC Stock Price Record.

The characteristics of target firms and bidders differ considerably. A description of the bidding and target firms represented in the sample is provided in Table 2, along with book value data. The median book value of the target firms is $21.0 million, while that of the bidding firms is $396.2 million. Competition for target firms at the time of the tender offer is limited, with only three competing offers found in the sample. This finding is similar to that reported in Masulis (1979), a study of tender offers for NYSE and ASE listed target companies in the period 1974-1978. Of the U.S. corporations included among the bidding firms, about one-half are from technology-based industries. Significantly, almost one-third of the bidding firms are foreign corporations or foreign-controlled U.S. companies. The sources for the book value figures were Moody's OTC and Industrial Manuals, Schedule 14D filings, and Fortune Magazine's "Directory of the 500 Largest Industrial Corporations Outside the U.S."

As seen in Table 3, bidders often hold a substantial percentage of the target firm's outstanding stock prior to the tender offer, while after

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8/ The individual firms' major industry classifications are derived from the SEC Corporation Index (as of March 1979).

TABLE 1

TECHNOLOGY-BASED INDUSTRIES*

SIC Industry Definition	SIC Code
Industrial inorganic chemicals	281
Plastic materials and synthetic resins, rubber and man-made fibers, except glass	282
Drugs	283
Industrial organic chemicals	286
Miscellaneous chemical products	289
Special industry machinery, except metal working machinery	355
Office computing and accounting machines	357
Communication equipment	366
Electronic components and accessories	367
Miscellaneous electrical machinery equipment and supplies	369
Aircraft and parts	372
Engineering laboratory, scientific research instruments and associated equipment	381
Measuring and controlling equipment	382
Optical instruments and lenses	383
Surgical, medical, dental instruments and supplies	384

*The source for this classification is Charles River Associates, An Analysis of Venture Capital Market Imperfections, prepared for the U.S. Department of Commerce, Experimental Technology Incentives Program (February 1976).

TABLE 2

SIZE OF TECHNOLOGY-BASED OTC TARGET FIRMS AND BIDDING FIRMS

Target Firm	Book Value ($ Millions)	Bidding Firm	Book Value ($ Millions)
Block Engineering, Inc.	5.656	Bio-Rad Laboratories**	10.792
Block Engineering, Inc.	5.656	Instrumentation Laboratory**	45.383
Victor Graphic Systems	6.185	Victor Comptometer	28.189
Data Card Corp.	6.209	Deluxe Check Printer, Inc.	103.625
Vega Precision Laboratories, Inc.	7.209	CompuDyne Corp.	28.189
Matalized Ceramics Corporation	8.111	Rosenthal Technik U.S.A Limited*	NA
Electro-Nite Co.	8.590	Yates Industries, Inc.	42.530
Viking Industries, Inc.	12.490	Heath Tecna Corporation**	40.336
Carterfone Communication Corp.	14.316	Cable & Wireless, Delaware, Inc.*	425.430
Archon Inc.	14.369	Iroquois Brands, Ltd.*	30.394
Tally Corp.	17.661	Mannesmann AG*	3,729.000
American Telecommunications Corp.	17.862	General Dynamics Corp.**	1,601.069
Overmyer Corp.	19.980	AGI Investments Pty. Ltd.*	698.618
Ventron Corp.	21.036	Aquitaine of North America (in Canadian $)*	367.044
Ventron Corp.	21.036	Thiokol Corp.**	208.496
Burdox Inc.	24.663	Gas Accumulator Corp.*	616.320
Litronix, Inc.	27.171	Siemens*	8,229.723
Comten, Inc.	27.532	NCR**	2,596.161
Oil Base, Inc.	29.117	Hughes Tool Co.	669.388
Gray Tool Company	30.119	Petrolane Inc.	298.071
Gray Tool Company	30.119	Combustion Engineering Inc.	1,094.485
Liquidonics Industries, Inc.	31.580	VSI Corporation	102.637
Microdata Corp.	31.648	McDonnell Douglas**	3,098.229
Morgan Adhesives Co.	56.698	Bemis Co., Inc.	326.024
Mostek Corp.	72.428	United Technologies**	4,074.235
Foster Grant Co., Inc.	90.692	United Brands Co.	1,117.839
Foster Grant Co., Inc.	109.631	United Brands Co.	1,237.908

*   Foreign corporation or foreign-controlled corporation.

** Technology-based domestic firm.

TABLE 3

DISTRIBUTION OF BIDDER HOLDINGS OF TARGET STOCK
BEFORE AND AFTER THE TENDER OFFER

Bidding Firm	Pre-Offer Bidder Stockholdings as % of Stock Outstanding	Post-Offer Bidder Stockholdings as % of Stock Outstanding
United Brands Co.	39.8	54.2
United Brands Co.	54.2	69.9
Bemis Co., Inc.	69.0	76.0
Deluxe Check Printers, Inc.	0*	72.7
Aquitaine of North America +	0	withdrew
Victor Comptometer+	69.0	96.0
Thiokol Corp.+	0	94.7
Petrolane Inc.+	0	withdrew
Combustion Engineering Inc. +	34.0	99.3
Rosenthal Technik U.S.A. Limited+	0	99.9
Iroquois Brands, Ltd.+	35.2**	99.0
Gas Accumulator Corp.+	0	98.3
Yates industries, Inc.+	12.7	20.8
Cable & Wireless, Delaware, Inc.+	0	99.0
Heath Tecna Corporation+	0	49.2
Bio-Rad Laboratories+	32.0	100.0
Instrumentation Laboratory+	0	withdrew
VSI Corporation+	79.0	96.3
General Dynamics Corp.	0	40.5
Mannesman AG Inc.	31.0	99.9
Siemens	80.0	99.8
NCR Corp., Inc.	0	45.4
CompuDyne Corp.+	0***	93.6
McDonnell Douglas	0	96.0
Hughes Tool Co.+	57.8	98.9
ACI Investments Pty. Ltd.	0	25.0
United Technologies Corp.	20.8	92.2

+   Sought all non-bidder owned stock outstanding.

*   Held debentures convertible into 323,077 shares. There were 1,475,000 shares outstanding.

** Also held options to buy 19.5% of stock, which was exercised before expiration of the tender offer.

*** Entered into agreements to buy 25.6% of stock, which were implemented before expiration of the tender offer.

the offer the bidders' stockholdings generally represent majority

control and often almost complete ownership of the target firm's stock.

This finding reflects the fact that in two-thirds of the offers, all

non-bidder held shares were sought (defined as "any and all" tender

offers).   Apparently, bidders do not simply want management control,

but rather 100% ownership of target firms.

A more detailed description of the shares sought, tendered, and

purchased is offered in Table 4. From this table, it can be seen

that only five of the tender offers in the sample were oversubscribed,

which is to be expected given that most offers are for all non-bidder

held stock. Further, there was pro rata purchase of stock in only

two cases. In the other oversubscribed offers all stock tendered was

purchased, even though less was sought. The sources for Tables 3 and

4 are the individual Schedule 14D filings and the Wall Street Journal

Index.

The two key dates in this study are the initial offer announcement

and offer expiration dates. The sources for the initial offer announcement

dates are the offer prospectus and the Wall Street Journal Index, while

the source for the offer commencement and expiration dates is the individual

Schedule 14D filings. Table 5 lists the initial announcement, commencement,

and expiration dates of each tender offer (where the date is in order

of year/month/day). Note that two-thirds of the offers are in the second

half of the sample period. The median duration of these tender offers

is 23 business days, while the initial announcement of the offer precedes

the commencement date by less than a week for half the offer sample. In a

study of 153 tender offers for NYSE and ASE listed target firms over the

period 1974-1978, Masulis (1979) found a median length between terms

TABLE 4

STOCK SOUGHT, TENDERED, AND PURCHASED IN TENDER OFFERS

Bidding Firm	% Sought of Stock Outstanding	% Tendered of Stock Outstanding	% Purchased of Stock Outstanding
United Brands Co.	27	14	14
United Brands Co.	9	16	16
Bemis Co., Inc.	12	7	7
Deluxe Check Printers, Inc.	44	73	73
Aquitaine of North America	100	0	0
Victor Comptometer	11	7	7
Thiokol Corp.	100	95	95
Petrolane Inc.	100	0	0
Combustion Engineering, Inc.	66	65	65
Rosenthal Technik U.S.A. Limited	100	100	100
Iroquois Brands, Ltd.	45	46	46
Gas Accumulator Corp.	100	98	98
Yates Industries, Inc.	87	8	8
Cable & Wireless, Deleware, Inc.	100	99	99
Heath Tecna Corporation	100	49	49
Bio-Rad Laboratories	68	68	68
Instrumentation Laboratory*	100	0	0
VSI Corporation	21	17	17
General Dynamics Corp.	45	41	41
Mannesmann AG	69	69	69
Siemens	20	20	20
NCR Corp., Inc.	45	61	45
CompuDyne Corp.	75	68	68
McDonnell Douglas	100	96	96
Hughes-Tool Co.	42	41	41
ACI Investments Pty. Ltd.	20	34	25
United Technologies Corp.	79	71	71

* Offer withdrawn.

TABLE 5

TENDER OFFER PERIODS

Target Firm	Initial Announcement	Commencement	Final Expiration
Foster Grant Co., Inc.	730521	730522	730604
Foster Grant Co., Inc.	740215	740412	740503
Morgan Adhesives Co.	750516	750519	750620
Data Card Corp.	750521	750522	750616
Ventron Corp. (1)	760507	760618	760628
Victor Graphic Systems	760719	760719	760831
Ventron Corp. (2)	760729	760806	760830
Gray Tool Company (1)	760928	761001	761022
Gray Tool Company (2)	761020	761022	761110
Metalized Ceramics Corporation	770712	770727	770831
Archon Inc.	771020	771115	771229
Burdox Inc.	771213	771213	780120
Electro-Nite Co.	771214	780104	780130
Carterfone Communications Corporation	771021	771228	780209
Viking Industries, Inc.	780203	780228	780320
Block Engineering, Inc. (1)	780228	780512	780614
Block Engineering, Inc. (2)	780322	780519	780531
Liquidonics Industries, Inc.	780706	780706	780821
American Telecommunications Corp.	780404	780927	781012
Tally Corp.	781204	781204	790111
Litronix, Inc.	781025	781025	790130
Comten, Inc.	790119	790122	790213
Vega Precision Laboratories, Inc.	781222	790214	790320
Microdata Corp.	790719	790816	791003
Oil Base, Inc.	790731	790801	791012
Overmyer Corp.	791017	791017	791113
Mostek Corp.	790926	790928	791115

announcement and final expiration of 23 business days, thus indicating
that the offers in the present study are very similar in terms of offer
duration to the more extensively analyzed tender offers for NYSE-ASE
listed target firms.

6. METHODOLOGY FOR ASSESSING THE SIGNIFICANCE
   OF ANNOUNCEMENT EFFECTS

The approach utilized in this study to assess the impact of new in-
formation on security prices is termed the Comparison Period Return approach.
This method averages stock returns for common event dates to create a time
series of portfolio returns, where an event date is a defined number of trading
days before or after the particular announcement date under study (defined as
"day 0"). The announcement period is defined to include day 0 and, in
addition, "day + 1." The day +1 return is included to capture the effects of
announcements made after the close of trading on day 0.

To assess the impact of tender offer announcements on a sample of common
stock daily returns (unadjusted for contemporaneous market effects), first
a time series of these stock returns prior to and after the offer date under
study is obtained and defined as the "comparison period" returns (excluding
the announcement period days 0 and +1). The mean daily return of this time
series represents the security's "normal" return, assuming the return process
is stationary and that the time series is representative of the security's
return distribution. Forming a portfolio of these daily returns in event time
allows us to invoke the Central Limit Theorem (given that these returns are
from noncontemporaneous calendar time and therefore are independent in event
time) to justify a t-test of the significance of the difference between the
portfolio's announcement period mean daily return and comparison period mean

daily return. 9/ If there is a significant announcement effect on the stock price, the null hypothesis of equal means should be rejected in favor of the alternative hypothesis of an announcement effect. 10/ Brown-Warner (1980) compares the power of this methodology and the standard market model approaches and concludes that, for the case of noncontemporaneous announcement dates, the Comparison Period Returns approach is at least as powerful and often more powerful than standard market model approaches in assessing the impact of new information on stock prices. In applying the Comparison Period Returns approach, it is assumed that the appropriate length of the comparison period is twenty trading days before and after the two-day announcement period.

9/ See Mood-Graybill-Boes (1974), p. 435. This is a standard difference of means test statistic which is t-distributed with parameter $T_1 + T_2 - 2$:

$$t = \frac{\bar{\bar{r}}_1 - \bar{r}_{to}}{\sqrt{\dfrac{(T_1 - 1)s_1^2 + (T_2 - 1)s_2^2}{T_1 + T_2 - 2}} \; \sqrt{\dfrac{1}{T_1} + \dfrac{1}{T_2}}}$$

where T_1 = number of portfolio daily returns in the comparison period;

T_2 = number of portfolio daily returns is the announcement period;

$\bar{\bar{r}}_1$ = portfolio's comparison mean daily return;

s_1 = standard deviation of the comparison period mean daily return;

$\bar{r}_{to}$ = portfolio's announcement period mean daily return; and

s_2 = standard deviation of the announcement period mean daily return.

The test procedure used here is similar in spirit to tests using a matched pair comparison, although the pairs are of unequal size. Note that this t test assumes that the true standard deviations for the two periods are equal.

10/ A more detailed discussion of this methodology is found in Masulis (1980).

7. EMPIRICAL RESULTS

In evaluating the effect of tender offers on target stockholders, three measures need to be considered: the offer premium; the offer period return; and the weighted average of the two effects (as reflected in the announcement period return). Table 6 presents the individual offer premiums, where the offer premium is defined as the offer price minus the stock price one trading day prior to the announcement of the offer's terms, all divided by the latter price. All but two of the offer premiums are positive, as is to be expected. 11/ The median premium is 21%, which is almost identical to the median premium found in Austin's study of all tender offers over the 1976 - mid-1979 period. This strongly suggests that tendering stockholders of smaller technology-based firms benefit as much as other OTC, NYSE and ASE target stockholders who tender. Finally, it is interesting to note that the size of the premium does not seem to be closely related to the percentage of outstanding stock being sought or to the percentage of non-bidder owned stock sought.

While positive offer premiums indicate that tendering stockholders in "any and all" tender offers are made better off, this does not imply that the remaining minority stockholders are better off as well. However, if the offer period returns (defined as the stock price one trading day

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11/ In the two cases of nonpositive premiums, the announcement of the offer's terms occurred after an initial announcement of a possible purchase of stock, and as a consequence, the premium is hidden by the initial stock price rise at the time of the initial announcement. If the pre-announcement price was based on this initial announcement date, large premiums would be implied in both cases.

TABLE 6

OFFER PREMIUMS AND PERCENT OF OUTSTANDING STOCK
AND NON-BIDDER OWNED STOCK SOUGHT

Target Firm	Offer Premium	Percent of Outstanding Stock Sought	Percent of Non-Bidder Owned Stock Sought
Coment, Inc.	-.10	45	45
Morgan Adhesives Co.	0	12	39
Burdox Inc.	.01	100	100
Archon Inc.	.10	45	69
Gray Tool Company (2)	.10	66	100
Liquidonics Industries, Inc.	.10	21	100
Microdata Corp.	.10	100	100
Ventron Corp. (1)	.10	100	100
American Telecommunications Corp.	.13	45	45
Data Card Corp.	.13	44	44
Electro-Nite Corp.	.18	87	100
Oil Base, Inc.	.19	42	100
Viking Industries, Inc.	.20	100	100
Overmeyer Corp.	.21	20	20
Ventron Corp. (2)	.22	100	100
Victor Graphic Systems	.28	12	100
Litronix, Inc.	.32	20	100
Block Engineering, Inc. (2)	.36	100	100
Foster Grant Co., Inc.	.41	9	20
Mostek Corp.	.41	79	100
Gray Tool Company (1)	.42	100	100
Foster Grant Co., Inc.	.48	28	47
Vega Precision Laboratories, Inc.	.50	75	75
Tally Corp.	.58	69	100
Carterfone Communications Corporation	.63	100	100
Block Engineering, Inc. (1)	.71	68	100
Metalized Ceramics	1.82	100	100
1st Quartile	.10	28	47
Median	.21	68	100
Mean	.32	62	82
3rd Quartile	.42	100	100

after final expiration minus the stock price one trading day prior to the

terms announcement date, all divided by the latter price) are positive,

then it can be concluded that all the target firm's stockholders are made

better off by the tender offer. Table 7 presents the offer period returns

for all but six of the non-withdrawn tender offers. In these six cases,

no reliable quotes were available after offer.expiration, so that the offer

period return could not be calculated. In all but two of the remaining

offers, the offer period returns were positive, while the median offer

period return was 21.4%. Together, these two observations indicate

that the minority stockholders were also generally made better off.

As an alternative means of evaluating the total benefit to target

stockholders of a tender offer, we will look at the stock return at the

date of announcement of offer terms. 12/ Looking at the announcement

period returns also enables us to compare the average benefit to

the stockholders of small technology-based firms with that experienced

by stockholders of larger NYSE and ASE listed target firms. Examining

the portfolio's returns surrounding the initial announcement of

tender offer terms yields the results shown in Table 8. This portfolio's

announcement period mean daily return, representing 27 target firms'

stock, is 9.2%. In contrast, the mean daily return in the 40-day

comparison period is .7%. The t statistic for the difference between

these mean daily returns is 11.9, which is statistically significant

at the 1 percent level.

12/ The date of announcement of offer terms coincides with the initial
    announcement of an offer in a majority of cases. However, when
    separate announcements are made, the analysis is based on the
    final price change occurring around the date of announcement
    of offer terms.

TABLE 7

OFFER PERIOD RETURNS AND PERCENT OF OUTSTANDING
STOCK SOUGHT FOR TARGET FIRMS*

Target Firms	Common Stock Offer Period Returns (%)	% of Outstanding Stock Purchased
Overmeyer Corp.	-11.9	25
Viking Industries, Inc.	-6.5	49
Morgan Adhesives	1.9	7
Comten, Inc.	2.6	45
Liquidonics Industries, Inc.	10.0	17
Oil Base, Inc.	19.2	41
Ventron Corp.	19.4	95
American Telecommunications Corp.	20.4	41
Microdata Corp.	20.7	96
Electro-Nite Co.	22.1	8
Victor Graphics Systems	25.0	4
Litronix, Inc.	29.6	20
Tally Corp.	35.2	69
Mostek Corp.	39.2	71
Vega Precision Laboratories, Inc.	42.9	68
Data Card Corp.	45.7	73
Block Engineering, Inc.	94.2	68
Metalized Ceramics Corporation	170.5	100
Minimum	-11.9	4
1st Quartile	10.0	20
Median	21.4	47
Mean	32.2	50
3rd Quartile	39.2	71
Maximum	170.5	100

* Only 18 non-withdrawn offers had post-expiration prices available for computing offer periods returns.

TABLE 8

COMMON STOCK DAILY RATES OF RETURN FOR TARGET FIRMS

Event Day	Portfolio Daily Return (%)	Percentage of Stock Daily Returns Strictly Positive
-20	.001	.259
-19	.013	.296
-18	.006	.370
-17	.004	.407
-16	.041	.444
-15	.002	.259
-14	.006	.333
-13	.024	.296
-12	.017	.370
-11	.014	.333
-10	.016	.296
-9	.001	.222
-8	.007	.259
-7	-.003	.185
-6	.002	.259
-5	.009	.222
-4	.006	.222
-3	.007	.370
-2	.018	.444
-1	.004	.333
0	.131	.741
1	.053	.519
2	.002	.259
3	.012	.407
4	.011	.307
5	.007	.222
6	.003	.222
7	.002	.222
8	.002	.185
9	.004	.259
10	.004	.222
11	.006	.296
12	.006	.296
13	.000	.185
14	.007	.333
15	.003	.259
16	.004	.259
17	.002	.185
18	.002	.074
19	-.001	.222
20	-.003	.185
21	-.001	.111

Announcement Period:
Mean Portfolio Daily Return (%) = 9.2
    Standard Deviation (%) = 5.5
Percentage of Stock Daily
Returns Strictly Positive = 63.0
    Standard Deviation (%) = 15.7

Comparison Period:
Mean Portfolio Daily Return (%) = .7
    Standard Deviation (%) = 1.0
Percentage of Stock Daily
Returns Strictly Positive = 27.4
    Standard Deviation (%) = 10.7

The two-day announcement period return is 19.3%, which is almost identical to the announcement period return observed by Dodd--Ruback. 13/ This evidence also suggests that target stockholders of smaller technology-based firms benefit from tender offer to the same degree as stockholders of larger firms with stock listed on the NYSE and ASE. In sum, these results support the conclusion that tender offers are, on average, beneficial to target stockholders and that the size of these benefits appears to be similar to those realized by larger target firms.

While tender offers are usually beneficial, the question remains as to whether this conclusion holds for all the tender offers in the sample. Table 9 indicates that only three of 27 stocks do not have strictly positive two-day announcement period returns. Furthermore, as predicted by equation (2), there is a positive relationship between the magnitude of the announcement period return and the offer premium. However, no strong relationship between the announcement period return and the offer period return is observed, where $\overline{P}_E$ is assumed to be equal to the stock's price the day following offer expiration. This latter result reflects the fact that most of the offers in the sample were for "any and all" stock and only two offerors purchased stock on a pro rata basis. Thus, the probability of having stock tendered and purchased is large, so that $(1 - \alpha)$ is generally quite small, as is the $(1 - \alpha)R_O$ term in equation (2). The resulting prediction is that a close relationship exists between the announcement period return and the offer premium, which is consistent with the observed relationship.

13/ However, note that Dodd-Ruback used monthly stock returns.

TABLE 9

COMMON STOCK ANNOUNCEMENT PERIOD RETURNS FOR TARGET FIRMS

Two-Day Announcement Return	Offer Premium	Offer Period Return	Fraction Sought of Stock Outstanding
-.09	-.10	.03	.45
0	0	.02	.12
0	.10	.10	.21
.01	.01	—	1.00
.04	.36	—	1.00
.05	.10	—	.66
.05	.28	.25	.12
.06	.10	.21	1.00
.06	.13	.20	.45
.07	.21	-.12	.20
.09	.10	—	.45
.10	.19	.19	.42
.11	.13	.46	.44
.12	.42	—	1.00
.13	.41	—	.09
.15	.20	-.07	1.00
.16	.22	.19	1.00
.22	.10	—	1.00
.23	.32	.30	.20
.23	.71	.94	.68
.24	.18	.22	.87
.34	.41	.39	.79
.35	.63	—	1.00
.36	.50	.43	.75
.42	.48	—	.28
.56	.58	.35	.69
1.06	1.82	1.70	1.00

	Two-Day Announcement Return	Offer Premium	Offer Period Return	Fraction Sought of Stock Outstanding
1st Quartile	.05	.10	.07	.28
Median	.12	.21	.22	.68
Mean	.19	.32	.32	.62
3rd Quartile	.24	.42	.41	1.00

8. CONCLUSION

In general, stockholders of smaller technology-based target firms appear to benefit from tender offer activity. As a result, capital formation by these firms is enhanced by the possibility that stockholders will eventually be able to sell their stock at a tender offer premium. The overall findings of this study consistently support the conclusion that tender offers for smaller technology-based firms are very similar in character and effect to other tender offers which have previously been studied. Consequently, even though there is a relatively small number of tender offers in the sample, the consistency of the results with the earlier findings based on much larger sample sizes suggests that these results are more robust than their sample size would indicate.

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